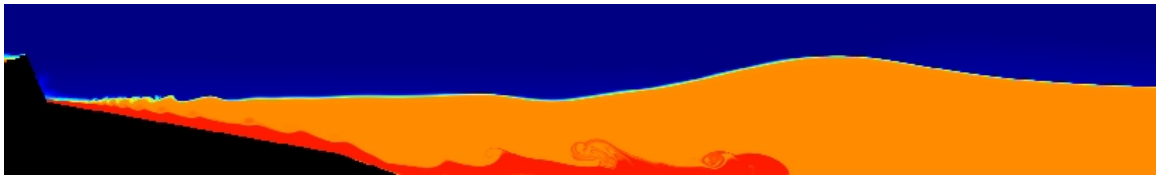

ABSTRACT

SAGE Calculations of the Tsunami Threat from La Palma
{LA-UR-05-3804}

With the LANL multiphysics hydrocode SAGE, we have performed several two-dimensional calculations and one three-dimensional calculation using the fully compressible Navier-Stokes equations, of a hypothetical landslide resembling the event posited by Ward and Day (2001), a lateral flank collapse of the Cumbre Vieja Volcano on La Palma that would produce a tsunami. The SAGE code has previously been used to model (quite successfully) the Lituya Bay landslide-generated tsunami (Mader & Gittings, 2002), and has also been used to examine tsunami generation by asteroid impacts (Gisler, Weaver, Mader, & Gittings, 2003). This code uses continuous adaptive mesh refinement to focus computing resources where they are needed most, and accurate equations of state for water, air, and rock. We find that while high-amplitude waves are produced that would be highly dangerous to nearby communities (in the Canary Islands, and the shores of Morocco, Spain, and Portugal), the wavelengths and periods of these waves are relatively short, and they will not propagate efficiently over long distances.

We validate these models by using similar models of the Ritter Island 1888 tsunami, which has similar geometry at smaller scale, achieving good agreement with the historical data.

We conclude with a discussion of the relevant physics that needs to be included in a reliable calculation of tsunami generation mechanisms involving the coupling of rock motion to water wave generation. There are choices for modeling the rock motion including viscid or inviscid flow, plastic flow, or granular flow, and these are presently not well constrained by the available data, though there are some possible indirect constraints. The expense of fully compressible simulations may be justified by a better understanding of the energy coupling between the various components (rock, water, and air) involved in tsunami source generation mechanisms.